DOCUMENT RESUME

ED 390 732 SO 025 483

TITLE	Sound Planning for Music Facilities. Revised.
INSTITUTION	Oregon State Dept. of Education, Salem.
PUB DATE	79
NOTE	20p.
AVAILABLE FROM	Oregon Department of Education, 700 Pringle Parkway S.E., Salem, OR 97310.
PUB TYPE	Guides - Non-Classroom Use (055)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Acoustical Environment; Elementary Secondary Education; Facilities; *Fine Arts; *Humanities Instruction; *Music; *Music Education; *Music Facilities; State Curriculum Guides; State Regulation; State Standards
IDENTIFIERS	Oregon

ABSTRACT

This booklet is designed as a reference for Oregon music educators and administrators who are considering building or improving school music facilities. It outlines typical specifications and points out problem areas that can spoil an otherwise well-planned facility. The booklet is divided into seven parts. The areas addressed include: (1) "The Music Complex"; (2) "Elementary General Music Area"; (3) "Acoustics"; (4) "Sound Isolation"; (5) "Support Areas"; (6) "Special Considerations"; and (7) "Sample Plans for the Music Complex." (EH)

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SOUND PLANNING

FOR

MUSIC FACILITIES

Revised
Fall 1979

Verne A. Duncan
State Superintendent of
Public Instruction
Oregon Department of Education
700 Pringle Parkway SE
Salem, Oregon 97310

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FOREWORD

Sound Planning for Music Facilities is designed as a reference for music educators and administrators who are considering building or improving school music facilities. It outlines typical specifications, and points out problem areas that can spoil an otherwise well-planned facility.

When planning, information should be gathered from all available resources: local music teachers, acoustic experts, architects, books and periodicals, as well as visits to existing facilities. In addition, **Planning and Equipping Education Music Facilities** ($12) and **The School Music Program: Descriptions and Standards** ($2), available from the Music Educators National Conference, contain detailed information useful when planning and working with architects and contractors. Please write:

Music Educators National Conference
1902 Association Drive
Reston, Virginia 22091

For further information, contact Del Aebischer, Music Education Specialist at the Department, 378-3617.

ACKNOWLEDGMENTS

The Department would like to thank review committee members for their contributions to this publication.

William Covert - Madison High School, Portland School District 1J

David Doerksen - Salem School District 24J

Sandra Doerksen - Salem

Lynn Lawrence - Corvallis School District 509J

John McManus - University of Oregon

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THE MUSIC COMPLEX

Grades 7 through 12

Instrumental Instruction Area

The large group instrumental instruction area should be 40 x 50 feet (2000 square feet) with a ceiling height of 16-20 feet, and room surfaces should be nonparallel. An area this size will accommodate an 80-piece band or 60-piece orchestra. For fewer or more performers, approximately 20 square feet or 400 cubic feet is needed for each additional student. It is difficult to provide for acoustical needs if the room is very much smaller than the dimensions above, especially with respect to ceiling height.

Vocal Instruction Area

A room 35 x 40 feet (1400 square feet) with a ceiling height of 14-18 feet will accommodate 75 vocalists. Eighteen square feet per student is adequate, but in figuring for fewer than 75 students, acoustical problems must be taken into consideration. Again, room surfaces should be nonparallel.

The Music Complex

Assuming that the music facilities will include an instrumental area and a vocal instruction area, the total music instructional area for even small schools should be a minimum of 5000 square feet. This allows for 1600 square feet for support areas (practice rooms, offices and storage).

ELEMENTARY GENERAL MUSIC AREA

A room 32 x 36 feet (1152 square feet) with a ceiling height of 12-16 feet will accommodate 30 to 40 students, along with standard instruments and equipment. However, if the room is to be used for movement to music or instrumental instruction, more area is needed.

ACOUSTICS

There is no magical room design that will guarantee perfect acoustics. However, for best results follow the general recommendations below, consult an acoustics expert, and plan to experiment and make adjustments once the facility is in use.

Nonparallel Surfaces

All hard surfaces, including glass and chalkboard areas, should be nonparallel to help avoid undesirable flutter echoes. Trapezoidal design, irregular surfaces, and installation of baffles are ways to solve this problem.

Reverberation

Reverberation time (defined as the time required for any given sound to decrease in intensity to one-millionth of its original value) should be between 1.2 and 1.6 seconds for vocal and elementary general music rooms, and under 1.0 second for band rehearsal areas.

In controlling reverberation, it is important to install a proper mixture of materials for both absorption and reflection. For example, a ceiling should rarely be constructed of sound absorbing material only; it should also contain some reflecting surfaces to enable musicians to hear one another while playing and for verbal communication.

For best results, sound absorbing materials must be fairly deep in order to achieve adequate low-frequency absorption. These materials should be installed in patches, intermixed with reflective surfaces. Two exceptions to this "patch rule" are the floor and the area just behind the instructor, where absorbent materials are best. In some situations, portable acoustical panels might be used behind the instructor. Never paint sound absorbing panels.

Pressure Areas

Acoustical materials should be installed where sound pressures are at a maximum (e.g., where ceiling and walls meet or two adjacent walls join). Ceiling baffles or acoustical panels can be used.

Floors

Carpet is the best floor treatment in a room where sound control is imperative. Carpet helps control reverberation time and low-frequency reverberations and, better than any other method, it controls unwanted noise, such as that produced by foot movement, chairs, music stands, instruments, and percussion equipment.

Even if carpet costs as much to install and maintain as other flooring, it is more cost-effective when sound absorption qualities are considered -it reduces the need for other acoustical materials.

Drapery

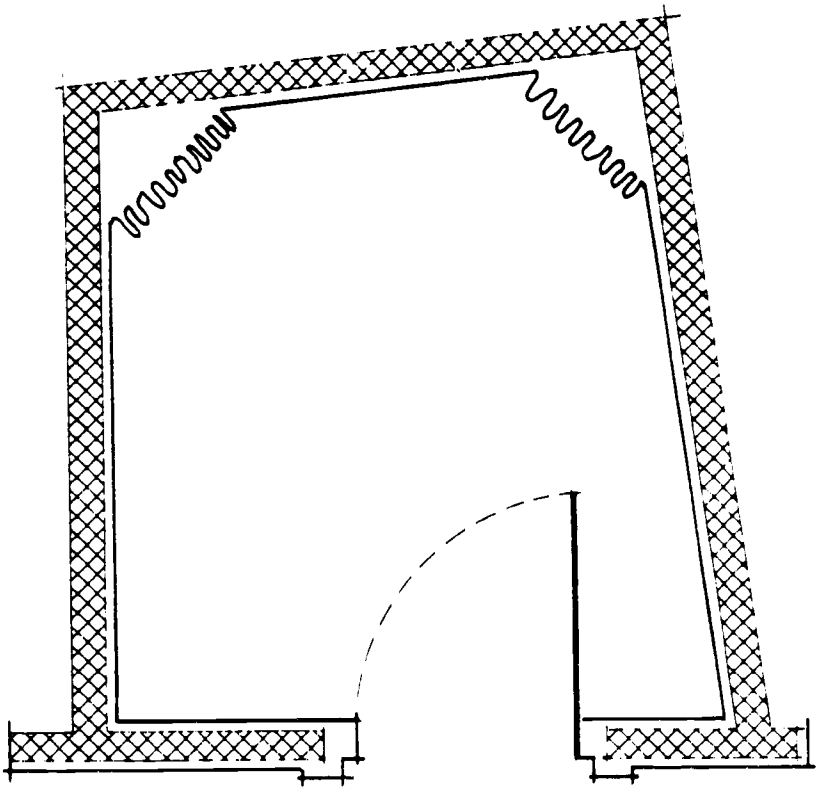
Consider installing heavy drapery on traverse rods in one or two large areas of the room. This makes it possible to alter the acoustical characteristics of the room for various size groups.

Practice Rooms

Consider purchasing module-type rooms, such as those available from the Wenger Company. These rooms are almost always acoustically superior to those built on-site. Some architects and acoustical engineers can design practice rooms which are the equivalent of commercially manufactured modules. However, this type of design work is expensive and, consequently, these rooms generally do not receive the attention they need.

It is recommended that either commercial modules be ordered, or that specifications for such modules be followed exactly when planning. If practice rooms are built on-site, they should be at least 55 square feet, and employ a considerable amount of sound-absorbent material. Because there is a special problem with low-frequency resonance or "ring" in very small rooms, two corners should be treated with sound absorbing materials as diagrammed on the following page.

Practice Room Diagram



SOUND ISOLATION

The music instruction area should be located so that it does not disrupt other disciplines, while providing for a facility which allows for vocal and instrumental, small and large group rehearsals and instruction to be conducted simultaneously.

Sound isolation is a different problem than room acoustics; i.e., controlling reverberation. For example, carpet and other absorptive materials do control sound within a room but do not isolate sound from room to room. Attention should be given to the transfer of sound through partitions, ceilings, floors, ducts, windows, doors, and through the building structure. In order to correct sound transfer problems, all such transmission channels should be scrutinized.

Partitions

Generally, large group vocal and instrumental rehearsal areas should be separated by office, storage and practice rooms (see page 9, Sample Plans for the Music Complex). However, there are times when such instructional areas must share a common wall. It is still possible to stop the sound between these areas, but it may prove difficult and will definitely be costly.

The following table lists sample acoustical materials and their relative effectiveness. Before placing vocal and instrumental instructional areas next to one another, consider that two partitions with a dead air space between them are needed for sound isolation, or that a specially designed wall must be built. For example, a Sound Transmission Class (STC) rating of 50 is necessary to dissipate band sounds so that concurrent choral instruction is possible in an adjoining room.

SOUND INSULATION DATA TABLE*

NBS Panel No.	Description of Partition	Thick-ness Inches	Weight Pound/ Square Feet	Average Transmission Loss in Decibels 125-4,000 cps (STC)
528	Gypsum wallboard, two 1/2 inch sheets cemented together, joints wood-battened	1	4.5	30
522	Gypsum wallboard, four 1/2 inch sheets cemented together, fastened together with sheet-metal screws, dovetail-type joints paper-taped	2	8.9	37
428	Gypsum wallboard, combination of panel 522 and panel 528, separated by spring clip and channel system	4	13.4	41
509	Gypsum-lath and fiberboard core, 1/2 inch fiberboard held by spring clips between a sheet of 3/8 inch and a sheet of 1/2 inch gypsum lath, 1/4 inch air space between fiber-board and lath on each side, 1/2 inch gypsum plaster on outer lath faces	2-7/8	15.9	47
214	Plywood, 1/4 inch glued to opposite sides of 1 x 3 inch staggered wood studs, 16 inch o.c. in each leaf, 4 inch air space	4	2.9	26
215	Same as panel 214 except 1/2 inch gypsum wallboard glued to both plywood faces	5	7.0	46
236	Gypsum wallboard, 1/2 inch on opposite sides of staggered 2 x 4 inch wood studs, 16 inch o.c. wood-fiber wool blanket, 0.9 inch thick, stapled to studs in one set	5-1/2	13.8	45
**	Two sets of 2 x 4 inch wood studs, 16 inch o.c. separated by 1-1/2 inch spacing. Insulate partition with thick economy fiberglass batts with vapor barrier stapled to studs. Nail to both sides a single layer of 1/4 inch Bestwall Gypsum Sound Deadening Board. With laminating compound, apply to both sides 1/2 inch Bestwall Firestop type XXX. Complete by applying to both sides 1/2 inch Bestwall Firestop type XXX Eternawall.	10-1/4	9.29	55
182	Heavy wooden door, approximately 2-1/2 inch thick, special hardware, rubber gasket around sides and top, drop felt at sill	2-1/2	12.5	30
307	Brick, common	12	121	53
144	Cinder block, hollow, 4 x 8 x 16 inch, 5/8 inch gypsum plaster on both sides	5-1/4	35.8	46
308	Concrete block, hollow, 8 x 8 x 12 inch and 4 x 8 x 16 inch	12	79	49
***	Soundblox 6 x 8 x 16 inch type B 2 slots, 2 cavities filled with fibrous element, painted (Noise Reduction coefficient is .60-.70)	6		47

* Cyril M. Harris, *Handbook of Noise Control* (New York: McGraw Hill, 1957) Selected examples from tables of Sound Insulation Data, Appendix 20.1

** *Sound Advice*, page 17 (Portland, OR: Georgia Pacific Corporation, nd)

*** Proudfoot Company, Incorporated, "Soundblox Technical Information AIA File No. 39-B" (Portland, OR: Johnson Acoustical, nd)

Duct-work

Normal duct-work with standard air returns is not adequate. No common duct-work should be installed either between vocal and instrumental areas, or in such a way as to connect the music facility to other parts of the building. To decrease sound transmission through existing duct-work, both acoustical linings and baffles should be installed. This will reduce machinery noise and other sound transmission. For quiet yet adequate ventilation within the music facility, slow moving, belt-driven exhaust fans are suggested.

Windows

The treatment of windows is crucial. Double-glass panes with air space between is quite efficient for reducing sound transfer. To reduce rattle, panes should be nonparallel and set in either glazing compound or framed in felt padding.

Doors

An appreciable amount of sound travels through and around doors. Doors need to be heavy, of special sound-isolating construction, and fully weather-stripped on all four edges. Adequate hardware is necessary to provide ease in closing while ensuring a tight seal.

SUPPORT AREAS

Offices, storage, individual and small group areas are needed to complete the music complex. In addition, provision should be made for music needs in the auditorium, gymnasium, and service areas.

Five thousand square feet is the minimum amount of space needed for a music complex that includes both a vocal area and an instrumental instruction area, as well as support areas. In a district with one music teacher, one music instruction area is adequate; a minimum of 3600 square feet is needed.

Music Offices

An office should be provided for each rehearsal area. Important considerations are efficient use of teacher time, supervision and communication.

Teacher Time - Teachers' offices should provide ready access to music storage, recording equipment, storage for uniforms, robes and instruments, instrument repair area and practice areas without disrupting other music classes.

Communication - Music educators are involved in events which require consultation with others, both in and out of school. Parents, the press, and the business community need to be contacted frequently, and a place to meet and telephone access are essential.

Supervision - Offices should be located so as to allow for visual monitoring. Windows in the offices and other small rooms help with security and supervision.

Storage

Sheet music, large and small instruments, music stands, uniforms and robes need to be stored. In the instrument storage area, some compartments should be carpeted for storing large instruments such as tubas. In planning these areas, traffic flow is very important, as are safeguards against vandalism, dampness, rodents and moths. Storage for electronic equipment is needed for vocal and instrumental classes.

Other Equipment

Equipment considerations include:

built-in stereo speakers and movie screen
staff-lined and blank chalkboards
counter space
a deep sink for flushing wind instruments
a drinking fountain
electrical outlets appropriately located (such as one in the floor for amplifiers)
floor grates located so that it is not necessary to push a piano across them

Individual and Small Group Areas

Individual or small group project areas require listening posts for both disc and tape recordings, as well as space for practice areas. These areas need adequate light, heat and ventilation control, sound control within the room and sound transmission control.

Service Areas

It is important to have access to the music area, dressing rooms and restrooms for rehearsals and performances when other parts of the building are not in use. Building security must be considered, as well as ease of access to these areas.

The auditorium stage and the practice field should be readily accessible to the music department. It is preferred that the music rooms and stage be on the same level for moving pianos and other equipment. An access door or loading ramp is useful for concert trips, games and parades; this helps avoid moving instruments and equipment long distances through the building.

Auditorium and Gymnasium Planning

Although planning for auditoriums and gymnasiums is not emphasized in this pamphlet, it is extremely important that an experienced acoustical engineer be involved with the architect in designing any type of auditorium. Some basic considerations include:

The auditorium
- The proscenium arch is high enough to allow for sound projection.
- There is a sunken orchestra pit.
- There ar removable floor units to cover the orchestra pit for making an extension of the stage beyond the proscenium arch.
- The stage and the music rooms are on the same level.

The gym
- There is enough floor space for a pep band.
- There are adequate electrical outlets provided for amplifiers and other electrical equipment.

SPECIAL CONSIDERATIONS

Traffic Flow

Cross-traffic patterns and "funneling" students through narrow areas should be avoided. For example, consider the bottleneck that results if students quickly enter and exit the instrument storage room through a 36-inch door. Not only is this inefficient, it can also be a hazard to both students and instruments.

When entering the music complex, students should be able to deposit their books, pick up instruments and music, and then continue to their seats without backtracking or creating cross-traffic. Some music facilities have avoided traffic flow problems by enlarging the instrumental rehearsal areas and installing open storage shelves around room perimeters.

If appropriate, consider access to the auditorium, stage area and practice field. For instance, traffic flow can be a problem if the audience leaving the auditorium and performers leaving the stage use the same area.

Risers

There are advantages and disadvantages in using risers, either movable or stationary.

> Risers establish a neat, permanent seating arrangement; allow for better eye contact between teacher and students; allow the back rows of instruments/voices to project.
>
> Flat floor allows more flexibility in seating arrangements; allows for any additional room that may be needed when a musical score calls for more performers, such as an extra large percussion section; mellows the tone of the brass in the back rows allowing for better blend; allows piano, tympani, vibes, guitar amplifiers, and similar instruments and equipment to be placed anywhere in the room and be moved freely in and out of the room.

If stationary risers are to be installed, there should be enough additional level space available to set up the full orchestra, band, choir, etc. Many teachers prefer movable risers, which also can be used for concert purposes. Risers for instrumental groups should be 6-8 inches above the previous level, 60 inches deep, with the top riser 70-120 inches deep. Risers for vocal groups should be 6-10 inches above the previous level and 36-40 inches deep.

Ventilation

Temperature control and frequent changes of air are necessary since breathing speed and volume increase with the production of music; this requires larger duct-work than in the regular classroom. Humidity control is also important to protect pianos, string, woodwind, and percussion instruments from damage caused by excessive high or low humidity. Maintaining a 40 to 50 percent humidity level is recommended. Many schools now are installing air-conditioning as a means of temperature and humidity control.

Doors

Doors need to be of an adequate height and width so that instruments can be moved without incurring damage. Also, provisions need be made for moving special equipment, such as the grand piano, to the auditorium or stage area. While double-frame doors with no post in the center are best, an alternative is to install an easily removable mullion with a 3-1/2 to 4 foot door on each side.

Lighting

Lighting is very important in the music room, since both the teacher and the students need to concentrate carefully when reading music. Often, music manuscripts are difficult to decipher and safeguards must be taken to preserve visual health.

Intensity, control and reflection are the primary concerns. The amount of light intensity needed is quite high, 70-100 foot candles, but control is also important so that students are shielded from glare or direct sunlight. To reduce glare, room surfaces and furniture should be light in color, with minimum brightness contrasts. It also should be possible to darken the room for viewing projected materials.

In terms of economy, fluorescent lighting is recommended. Various studies suggest that the extra installation cost for fluorescent lighting pays for itself in five to seven years because fluorescent lights use only half as much electricity as incandescent lighting.

Fire Alarm

A fire alarm should be installed on the inside wall of the bandroom. Often, a fire alarm placed just outside the bandroom cannot be heard during full rehearsal.

SAMPLE PLANS FOR THE MUSIC COMPLEX

When planning a music complex, sound and class disruption, traffic flow, and supervision need to be considered.

Sound Disruption--Is there a buffer between rehearsal rooms, and between rehearsal and practice rooms, so that these areas may be used simultaneously? (See page 5 concerning the "bleeding" of sound through ducts, windows, doors.)

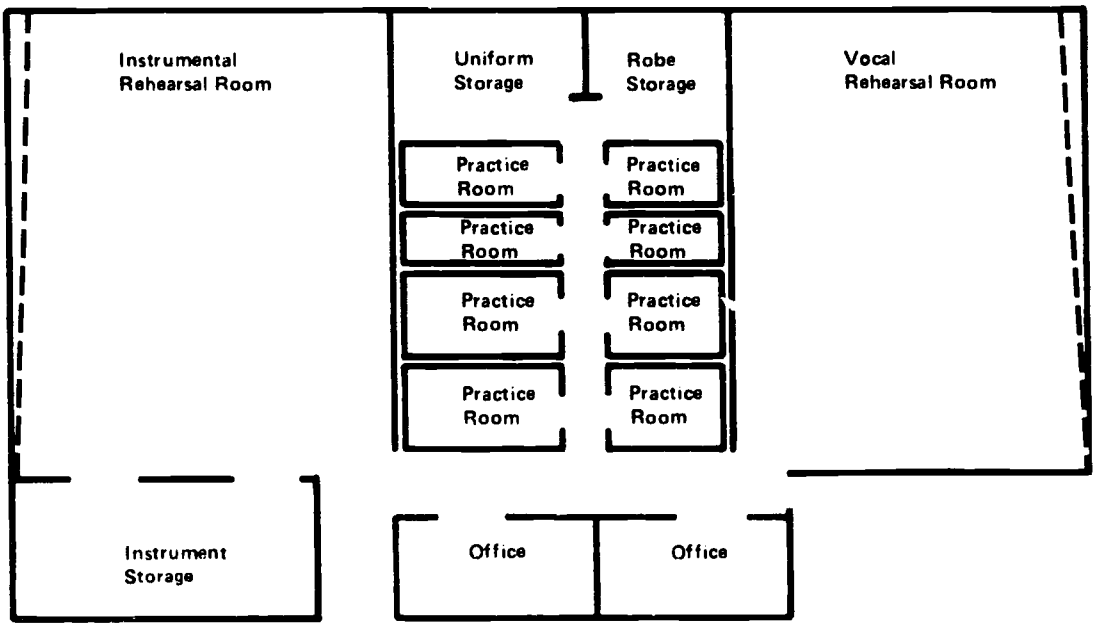
Class Disruption--Can practice and storage areas be reached without crossing the main rehearsal area?

Traffic Flow--Can students pick up instruments and music, and prepare for rehearsal without creating a bottleneck?

Supervision--Is adequate visual supervision possible from the offices and rehearsal rooms over practice, storage, large and small ensemble rooms? Would it be difficult for an unauthorized individual to leave the music complex with an instrument or amplifier without attracting attention?

The following illustrate some of the advantages and disadvantages of various floor plans in terms of the above questions.

FLOOR PLAN A



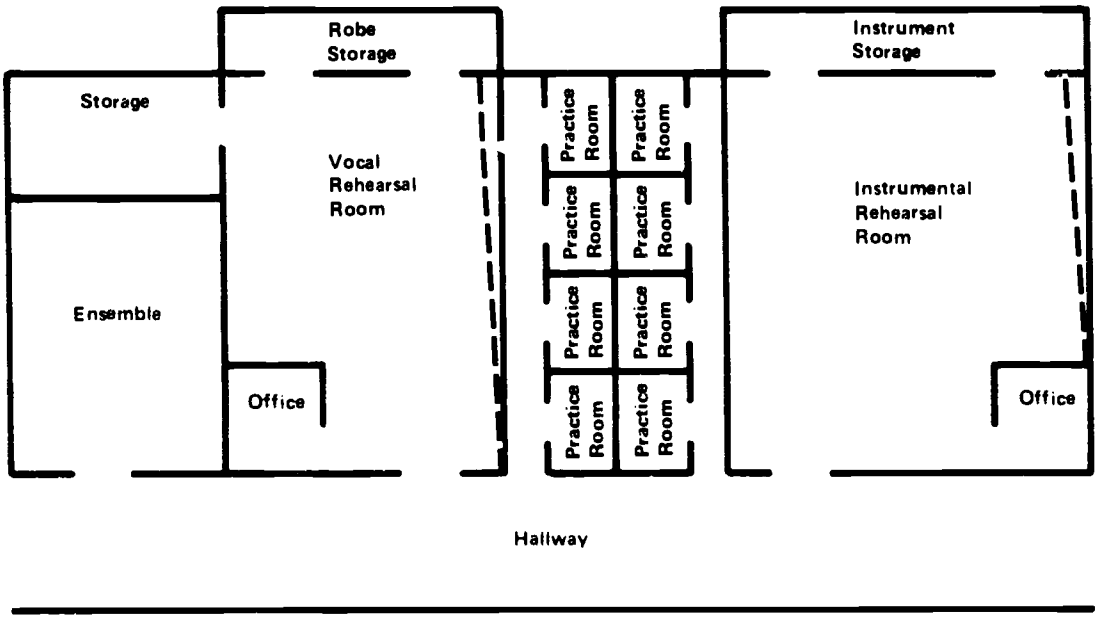
Sound Disruption There is a buffer between the two large rehearsal rooms, and double walls between rehearsal areas and practice rooms.

Class Disruption Practice and storage rooms can be reached without crossing the main rehearsal area.

Traffic Flow Students can pick up instruments without creating a bottleneck, but not uniforms and robes.

Supervision Supervision and security of rehearsal and instrument storage rooms is good. However, there is no visual monitoring of practice rooms, or uniform and robe storage rooms.

FLOOR PLAN B



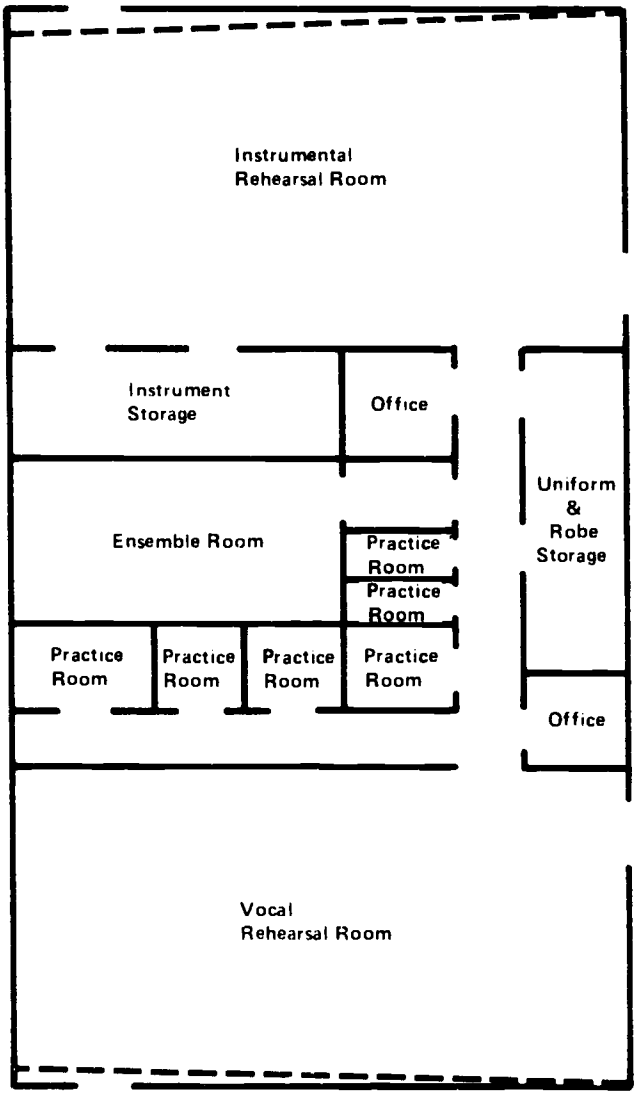
Sound Disruption There is a buffer between the two large rehearsal rooms, and between rehearsal and practice rooms.

Class Disruption Practice rooms can be reached without crossing rehearsal rooms, but storage rooms cannot.

Traffic Flow Traffic flow is good in and out of instrument and robe storage rooms.

Supervision Security for storage rooms is good, but visual monitoring of practice and ensemble rooms would be difficult.

FLOOR PLAN C



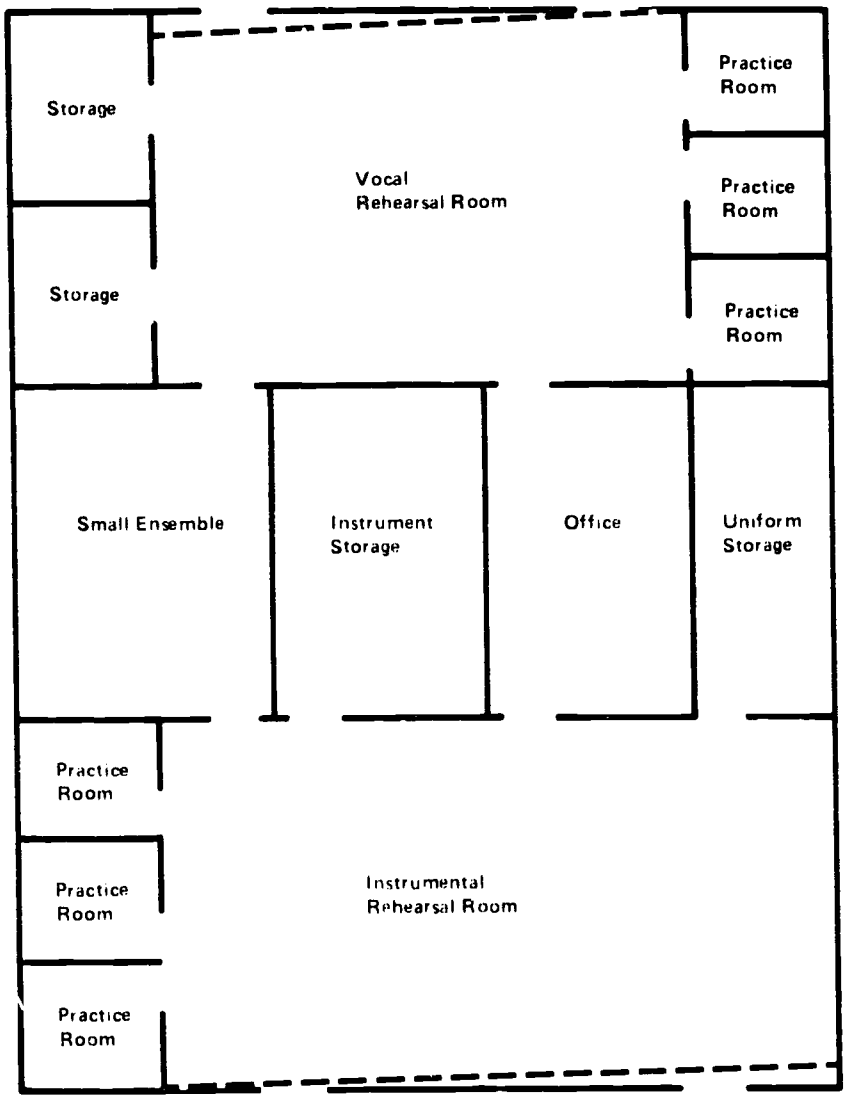
Sound Disruption There is a buffer between the large rehearsal rooms, and between rehearsal and practice rooms.

Class Disruption Practice and storage rooms cannot be reached without crossing the large rehearsal rooms.

Traffic Flow Instruments, uniforms and robes can be picked up without creating bottlenecks.

Supervision Security for storage rooms is good, but visual monitoring of the ensemble and practice rooms would be difficult.

FLOOR PLAN D



Sound Disruption There is a buffer between the two large rehearsal rooms, but none between practice and rehearsal rooms.

Class Disruption Practice and storage rooms can not be reached without crossing the large rehearsal rooms.

Traffic Flow Uniforms and instruments cannot be picked up without creating bottlenecks. There is only one door for entering instrument and other storage areas.

Supervision Visual monitoring of the music complex from the office and rehearsal rooms is quite good, but security is only fair since the office is some distance from the exits.

Note This floor plan is somewhat less expensive to build, since there are no hallways. From most standpoints it is the least usable floor plan.